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VARIATION IN *COLIAS ALEXANDRA CHRISTINA* EDWARDS

(PIERIDAE) IN SOUTHWEST MANITOBA

JOHN H. MASTERS¹

8126 Santa Inez Dr., Buena Park, California

MANITOBA LEPIDOPTERISTS HAVE TRADITIONALLY referred Manitoba populations of *Colias alexandra* Edwards to the subspecies *mayi* Chermock & Chermock; incorrectly however as *mayi* actually refers to *Colias gigantea* Strecker (e.g. Masters, 1971a), although they were assigned to *Colias christina* (now considered to be a subspecies of *alexandra*) by Chermock & Chermock (1940). The assignment of *mayi* to *gigantea*, ostensibly left the Manitoba population of *Colias alexandra* without a subspecific name which, in turn, led me to a series of studies which have culminated in this paper. In the course of this study I determined, to my complete satisfaction, that the Manitoba population of *Colias alexandra* is best referred to *Colias alexandra christina* Edwards of which *Colias eurytheme alberta* Bowman is a synonym (Masters, 1971b). This paper reports on the variability of *Colias alexandra christina* that is displayed in Manitoba populations.

SUBSPECIATION IN *COLIAS ALEXANDRA*

Colias christina (fig. 1) is the northern, predominately orange colored population of *Colias alexandra*. The orange *christina* phenotype occurs in the Great Slave Lake Region of the District of Mackenzie; south to Lake Athabasca and the Peace River Region of Alberta; thence eastward through northern Saskatchewan to the vicinity of The Pas, Manitoba; then southward along the Manitoba Escarpment to Riding Mountain and the vicinity of Brandon; and then appears again as an isolated population in the Black Hills of South Dakota (*krauthi* Klots). In southern Alberta and British Columbia, a broad band of gradual intergradation to the yellow phenotype (*alexandra*) begins. This intergradation zone continues through Montana,

¹Research Associate, Carnegie Museum, Pittsburgh, Pennsylvania.

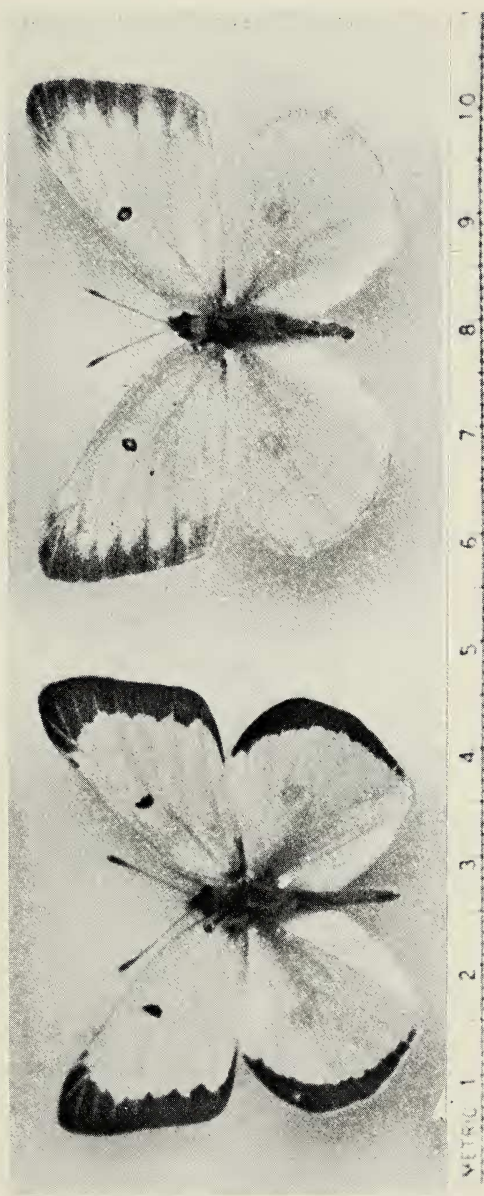


Fig. 1.—*Colias alexandra christina* Edwards, Birtle, Manitoba. Leg.: Jack Dennis. Male left, female right. Natural Size.

Idaho and northern Wyoming until typical *alexandra* is encountered in southern Wyoming and Colorado. The typical *alexandra* phenotype is found from Colorado; west into Utah; south into the White Mountains of Arizona and Sango de Cristo Range of New Mexico; and with an isolated offshoot in the Pine Ridge of Nebraska. The West Coast populations, are of a distinct albeit yellow phenotype. They range from the foothills in Southern California northward, west of the Sierra Nevada Divide and principally in foothills, to southern British Columbia. They are known as *harfordi* and *barbara* in the south and *occidentalis* and *chrysomelas* in the north. Hovanitz (1950) first allied all of these populations into one species, although this is still not universally accepted.

The name *astraea* Edwards is available to apply to the *alexandra/christina* blend zone population as a whole. Even though central Alberta specimens are quite distinct from northwest Wyoming ones, they are parts of the same cline.

MANITOBA POPULATIONS

In 1967, John Sorensen and I were of the opinion that Manitoba populations of *Colias alexandra* represented an undescribed subspecies. We were working on the mistaken premise that typical *christina* was represented by Southern Alberta populations as exemplified by specimens taken near Calgary. This is the same mistaken premise that many others (including Bowman, 1942) have made in dealing with *Colias christina*. Later comparisons of Manitoba *christina* with Edwards types of *christina* (at Carnegie Museum), other topotypical *christina*, Bowman's (1942) description and paratypes of *alberta* have convinced me that there are only statistical distinctions between them—and certainly not enough to warrant more than one sub-specific name. Southern Alberta "*christina*" as well as populations from the Alberta Rockies are distinct, however, and they are, statistically at least, distinct from typical *astraea* from Wyoming; they are, as I have previously stated, part of the same cline (between *alexandra* and *christina*) as *astraea* and the names *christina* or *alberta* in the strict sense cannot apply to them at all.

I recently had the opportunity to examine and classify the collection of Lepidoptera, now in the Manitoba Museum of Man and Nature, assembled by Jack Dennis at Birtle, Manitoba between 1898 and 1944. Of considerable interest in this collec-

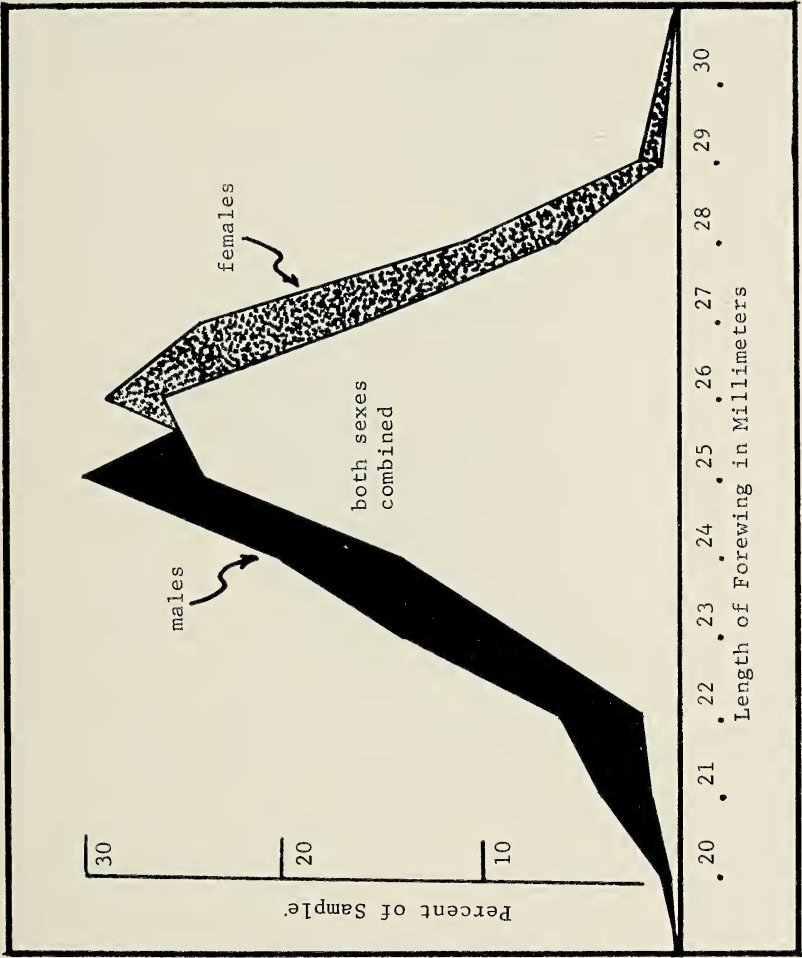


Fig. 2.—Distribution in size of 400 specimens of *Colias alexandra christina* from Birtle, Manitoba.

tion is a long series of *Colias alexandra christina*, containing over 400 specimens taken at Birtle over a 40 year span. Dennis was evidently very fond of *Colias christina* and dutifully filled at least one Riker Mount with 12 to 18 specimens of this species for each year he collected. This large collection, including specimens collected all season long for a lengthy period of time, provided an excellent opportunity to examine variation in this species at one given locality.

SIZE OF BUTTERFLIES. The first variable considered was the size of specimens, this was determined by measuring the length of the forewing to the nearest millimeter. The distribution in size for both sexes fall into typical bell-shaped curves (figure 2.). The median forewing length for males is 25 mm. and for females 26 mm., the average size for males slightly less than 25 mm. and for females slightly more than 26 mm. A series of 36 males and 36 females of topotypical northern Alberta *Colias christina* (at Carnegie Museum) displayed slightly smaller size. Alberta males had a median forewing length of 24 mm., with the average slightly more than 24 mm.; the range was between 22 and 27 mm. Alberta females had a median forewing length of 26 mm., with the average being slightly less than 26 mm.; the range was between 19 and 29 mm.

FLIGHT PERIOD. Dennis' capture dates were interpolated to determine the flight period at Birtle (figure 3.). The male flight period is between June 12th and July 5th with a peak between June 16th and 23rd when the females are beginning to emerge. The female flight period is somewhat later, occurring between June 16th and July 14th and peaking between June 26th and July 2nd. The lack of Dennis specimens between July 4th and 6th is probably the result of some other activity that Dennis was engaged in that prevented his from field collecting at this time (perhaps he always used the week following Dominion Day to cut hay) rather than by an absence of individual butterflies at this time. There is a complete lack of individuals with collection dates during this time period throughout the Dennis collection.

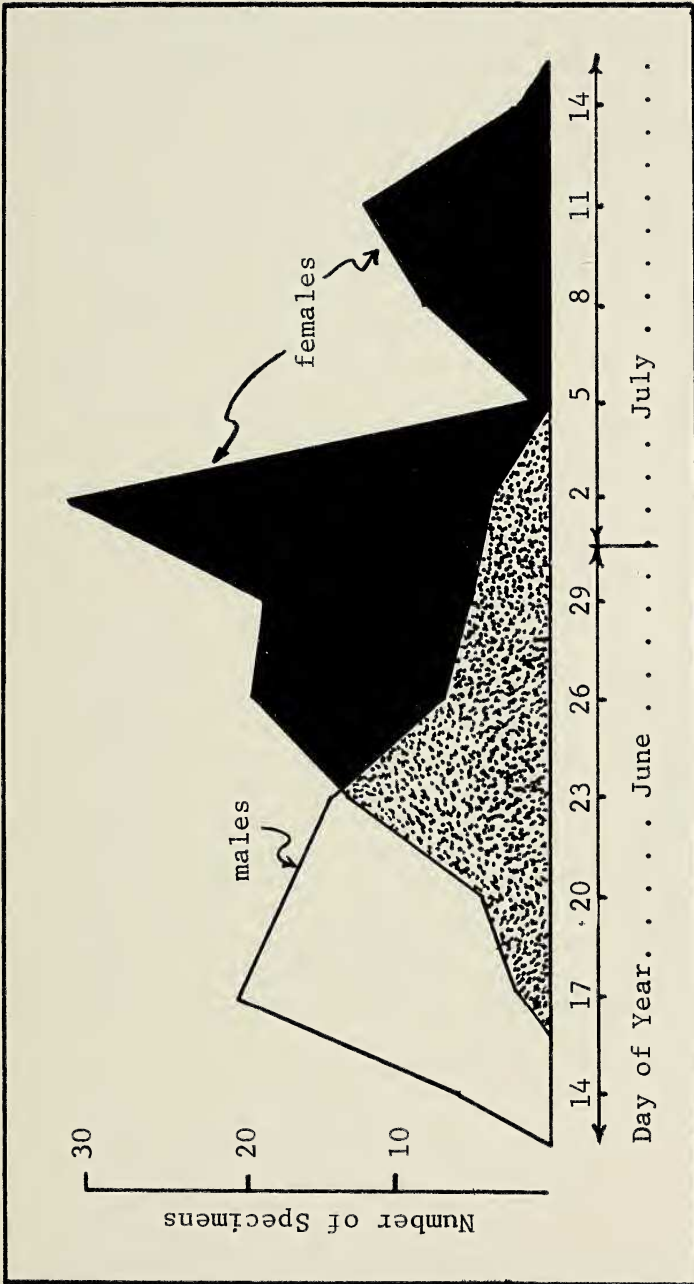


Fig. 3.—Flight period of *Colias alexandra christina* at Birtle, Manitoba as indicated by date of capture of specimens from the Dennis collection.

PHENOTYPE VARIATION. *Colias alexandra christina* is remarkable in that the males are extremely regular in appearance while the females are extremely variable. Males are always bright orange, with a basal yellow area, and have uniform black borders. Females may have an orange, yellow or white ground color and the black bands may be absent entirely or complete.

GROUND COLOR OF WINGS. 100% of the males examined had a uniform orange ground color to their wings. Of the females 68.1% were orange, 24.6% were yellow and 6.4% were white. Of the Alberta sample of nominate *christina*, only 27.8% of 36 females were orange, while 30.6% were yellow and 41.8% were white. The variation in the percentage of white females in *Colias* populations has been covered in detail by Hovanitz (1950b); he recorded 9.95% white females in Manitoba *Colias alexandra* and from 33.33 to 81.25% white females in various parts of Alberta. The relative lack of white females in the Manitoba population is unimportant from a subspeciation standpoint. The percentage of white females shows a great deal of geographical variation in all species of North American *Colias*.

BLACK BANDS OF WINGS. Males of *Colias alexandra* from localities throughout their range, display consistent black bands as in figure 1. Females, however, are quite variable showing a range from immaculate, to apex band on forewing, to outer band only, to complete band (see figure 4.). By judgement, although the distinctions are not discreet, each of 220 Birtle females was placed into one of the four categories with the following results: 1.8% showed immaculate wings, 14.5% had an apex band only, 22.8% had an outer band only and 60.9% had full bands. By comparison, the Alberta sample of 36 females contained 19.4% with immaculate wings, 44.4% with apex bands only, 22.2% with outer bands only and only 13.9% with complete bands. The bands of Alberta males are identical to the bands of Manitoba males.

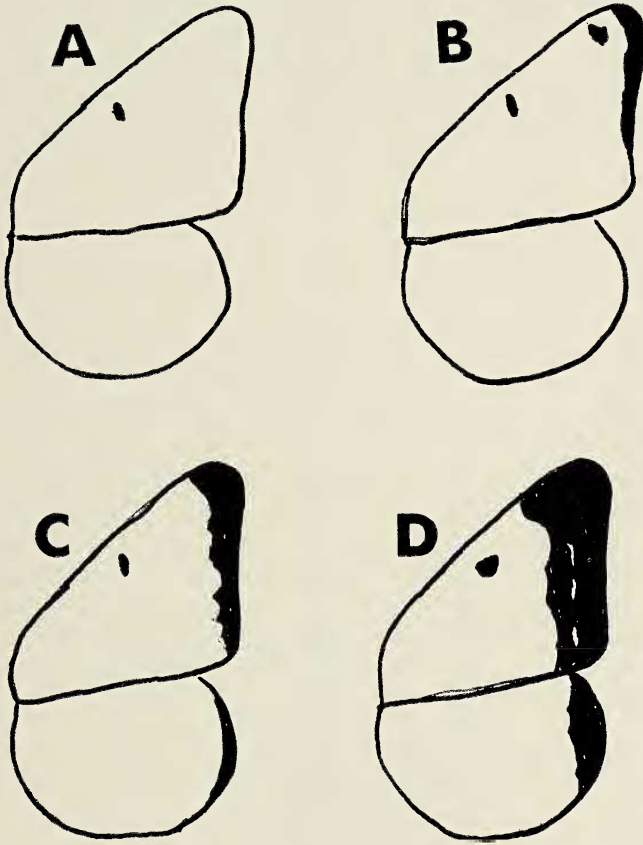


Fig. 4.—Variation in the dorsal black band patterns of female *Colias alexandra christina*. A. -immaculate wings. B. -band at forewing apex only. C. -outer band only. D. -complete band.

Condition of Black Band on Dorsal forewing	Ground Color of Wings			<u>TOTAL</u>
	<u>white</u>	<u>yellow</u>	<u>orange</u>	
<u>immaculate</u>	-	1.8%	-	1.8%
<u>apex only</u>	-	6.4%	8.2%	14.5%
<u>outer band</u>	0.9%	6.4%	15.4%	22.8%
<u>full band</u>	5.4%	10.0%	44.5%	60.9%
<u>TOTAL</u>	6.4%	24.6%	68.1%	100.0%

Fig. 5.—Table showing the co-ordinated abundance of the variation in the background color of the wings and the extent of black maculation of 220 females of *Colias alexandra christina* collected at Birtle, Manitoba.

CO-ORDINATED DISTRIBUTION OF BACKGROUND COLOR AND BLACK BANDS. The segregates of wing ground color and black band condition were platted against each other (figure 5.) to determine if there was any correlation between the two. Apparently there isn't and the genetic conditions that influence the black bands are independent of those that influence ground color. Nearly half, 44.5% of the Manitoba population displayed an orange ground color and complete wing bands. The Alberta sample of 36 females is too small to plot when 12 variables are involved. The largest individual segregate included 7 specimens (19.4%) with a yellow ground color and with apex bands only.

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